Survey report Kitui, Kenya

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Expert evaluation of model setup and preparations of future fieldwork

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Introduction

This mission was set up in the framework of the PhD research of Marthe Wens, aiming to simulate the role of adaptation behaviour in agricultural drought risk models. The research will assess drought risk under various future developments such as increased climate variability, climate change, socio-economic and demographic trends. Therefore, a hydrological model STREAM and a crop water production model AQUACROP will be applied. Besides, various scenarios on drought management will be simulated using a dynamic and heterogeneous agent-based decision model. Adopting the socio-hydrologic framework, natural risk model will be coupled with the human adaptation decision model in order to more accurately estimate future drought risk.

As part of the evaluation of the adoption behaviour of smallholder households in semi-arid rural areas in Eastern Africa, her thesis depicts a case study in Kenya within the Kitui district about 150 km's east of Nairobi, where the different agricultural and water management measures to mitigate and cope with drought among mixed small scale mixed crop-livestock farmers will be investigated. The main objective of the mission to Kenya was to establish contacts with stakeholders dealing both directly and in-directly with agricultural drought adaptation in Kenya and conduct a field visit. From these interviews and discussions, three main results were obtained:

- After the initial setup of the agent-based drought risk model, local expert feedback allowed to improve the model assumptions related to the farmers' behaviour and to evaluate the most important model parameters, hence ensuring stakeholder participation in the model development. Discussions with stakeholders helped identifying the most pressing local issues to assess with the model. Working demand-based (Which exact questions should we answer with the model?) supports the future adoption of the model results and eventually policy changes.
- By visiting example farmers and openly interviewing them, their opinion related to the adoption behaviour of fellow farmers and the effectiveness of certain drought adaptation measures was gauged. Their experience on searching for knowledge and money to invest in certain drought adaptation measures and their experience with showcasing their farm to other farmers hence listening to their questions and concerns shed a good light on which factors are important among the local smallholder crop-livestock farming households.
- The South-East Kenyan context was investigated in both previous steps. This knowledge is summarized in a schematic overview of (1) measures and strategies influencing drought risk, (2) leverages and limitations influencing the adoption of these adaptation options and (3) Governmental and non-governmental institutions and organisations influencing these adoption factors. This fuzzy map will serve as guidance on further model development, in order to be able to simulate the situation in Kitui in more detail.

Besides, while meeting with local students, farmers, translators, authorities and NGO's, close contacts were established that will be valuable when returning to the area for a systematic field visit, which will include an extensive farmer survey and the preliminary evaluation of the model outputs. The mission interviews were conducted involving large research for development institutions in Nairobi, and local authorities and NGOs Kitui district. Field visits to example farmers were held in the Kitui district.

1. Expert Knowledge to improve the model setup

During the 6 days of the mission, 4 discussion sessions were held with local authorities and NGOs, 2 meetings were organised with national research for development institutions and 1 focus group discussion was executed with local hydrology and watershed management students with pastoralist background. Below the main conclusions from these gatherings are compiled, after which you can find short specifications of each institution.

Discussions were held on the **main limiting factors for the adoption of climate-smart agriculture**. In the local office of the ministry of agriculture, they state that (in order of importance) (1) knowledge, (2) affordability (money, labour time), (3) risk perception, (4) possible gain and (5) social network are the most pressing issues.

(1) Also other visited officials and NGOs agree that **knowledge** is the key for the adoption of climate-smart agricultural practices; money can be limitation but most CSA do not cost much; time (attending the training consumes time, is only possible if small field or larger family that can work) and labour can be a limitation (busy/ woman's work). While government puts social network on the bottom of the list, local experts and NGOs do estimate the influence on neighbours / connected farmers more influential. They state that when some (educated) example farmers adopt a lot of adaptation measures through attending trainings and learning it from the media, then the measures spread better.

While the local government has **extension** high on the agenda, the services are perceived to be rather poor and not effective by the NGOs. Therefore, there are a lot of different extension services flooding the farmers, all organised by different organisations. This is not ideal as farmers do not know who to believe and loose interest. It is a real issue that farmers are bombarded with information and they do not know which to follow. Besides, often (mosly under pastoralists) the extension by NGOs is not **trust**ed, NGOs are perceived as very unfair to the poor, less than 50% of the money goes to the people in need / food relief, rest in the pockets of the workers. (i.e. book The Lords of Poverty).-NGOs do not aim for ultimate solutions (for dependency on aid rather than for local empowerment) because they benefit from coming back; no non-profit motive

However, it is still this extension chaos that allows farmers to learn about new adaptation measures. For example in the Mango cooperative, they have their own extension service: After the mango season they have **training** for the farmers on business skills and crop handling (eg. Storage); preferably on the fields but also often on location (providing allowance and accommodation support). During the crop season the training is face to face, by agronomists, check the quality of the crops and give private advice. Besides, they train the youth on grafting and handling of the seedlings, producing the seeds of all fruits.

(2) The farm example at Nyumbani Village shows that it is possible to have a resilient farming system with enough water harvesting structures to cope with droughts and a sustainable farm management that supports crop growth for market purposes. This village of 1500 young people is able to live almost autarkic; but there has been financial support from the US for many many years. The **costs of innovation** are too high for the average smallholder farmer to afford, only if you pump money into them they will be able to significantly stabilise and increase their productivity. SASOL provides me with data on the local costs of the implemented measures, so I can use the correct numbers in my model.

FSD found that farmers are most scared of falling sick (eg. Malaria), then they cannot work and do not have the financial means to buy **labour** for their fields (so no tilling happens, low crop growth). Besides they have to spend the money for improved seeds to health care. Their risk perception in this labour shortage that cannot be solved by paid labour because of financial limits; and which will be followed by less income (double risk) is higher than that of droughts as it is less frequent. However, diseases are linked to drought so this induces a double risk. Still, they often see insurance as an additional cost, not as a risk reducing measure.

(3) Concerning the evaluation of risk perception and real risk, it is suggested to get into contact with the Meteo services, who can provide valuable knowledge on their forecasting procedures, how this is transmitted to the farmers. This comparison could be used to check the **(perceived) necessity** of drought adaptation measures. Besides, they could give me measured past data that can be used in the model. However, the forecasts by the government are often not accurate;

The NDMA gives ATM cards as drought response tool: access to relief (money that can be spend to own needs, not just food that then will be sold) via equity bank. This could reduce the necessity for farmers to adopt new adaptation measures; however the compensation is far too low see households have to search for other options and invest in self-resilience.

(4) The possible **gain** of adaptation measures is highly influenced by the government as they have a large influence on crop choice and planting data. The Gvt supports the production of maize (key export product) via the cereal bowl program and regulate the price while the crop is very sensitive to droughts. This results in a **low demand** for drought tolerant crops like cassava or papaya

(5) Social networks are an important catalyser in the wide adoption of certain adaptation measures according to the NGOs. Learning farmers new farming practices is easy, as they train each other so it is a snowball effect. To overcome the limited governmental extension services, farmer to farmer knowledge spreading helps to overcome one of the major limitations to adopt sustainable agricultural practices.

On the benefit of a **tight network**: it might be interesting to include collective action in the model, as the some larger but very efficient adaptation strategies require close collaboration and upscaling of activities; for the construction of sand dams; the implementation of a community garden or the start-up of a cooperative. While cooperatives are an ideal form to ensure stable and proper income and avoid the brokers / have a better market, there are not a lot of cooperatives in the region (only one for mangoes and one for green grams). Having a good Market / large amount of possible sellers is one of the main limitations, as the scaling up requires producing not only for a local market; Also the commencement of a cooperative requires the input of external money and knowledge (on business management) via Projects / NGOs.

How is such bottom-up **cooperative** organised? First, a lot of famers should gather and form a group; this is easily achieved. Then they need to find an NGO who wants to set up a project with them (demand-based). Once it is running well, new farmers will ask to join the cooperative; the cooperative reaches the farmers via their social network, by word of mount and via the media. Once established, they can work autonomous and be a profitable enterprise, supporting sustainable income for all participating farmers.

How does such bottom-up **cooperative** works? The harvest gains of the cooperative are divided equitable among the farmers. They have different collection centres and the mangoes are

collected on their fields so farmers do not have transport costs. The cooperative provides the pesticides needed, so all farmers spray as routine management. Besides the cooperative provides loans for farmers if they want to buy more trees. They deduct the cost from their gain at the end of the season. They even discourage them to go to private banks because of the high interest rate of 7% and the complex bureaucracy.

Future perspective: The Gvt (NDMA) is now working on a Drought Emergency Response plan, which will be out in the next months. KIWASH institute helps them with the policy/law side of the plan. The main focus is on rainwater harvesting; improving soil moisture. Here the model I am developing would be ideal to use in order to test the proposed approach; also SASOL sees this as an opportunity and would like to help me write scenarios of **governmental strategies** in the model. They are very interested in understanding how people cope with drought. Besides, they suggest to bring me in contact with the NDMA, as a discussion with the technical scientists from this institute would be very valuable for my research, and it would be a great outreach for the results of my research.

ACRE (Amos, Agri Clim data analysis and Belinda, Business analyst, impact assessment)

ACRE focuses on the whole production chain, adopting a multi-risk approach. They work on irrigation adoption (eg SWA project; CSA, SWC) over insurance development (IBLI project, reduced premiums for good practices) to improving access to markets and finance, by surveying and monitoring the production risk (actual and perceived) for farmers. Their current focus is on planting date info and suggestions for crop type, as this is proven to highly influence crop yield (+80%).

ILRI (Fransesco Fava, Environmental scientist, RS spatial technologist)

IBLI Suggested contacts:

-Nathan Jensen

- Tod Crane (Climate adaptation science ,anthropologist)

- Mark van de Wiek (tools ofr HH level data collection)

- Petram Rowbani: Insititute for Development, Uni of Sussex: climate forasting in Kitui PhD student

- Contact NDMA for LT survey on drought impacts on livelihoods (Sentinel sites)

- Bring in contact flood insurance…

SASOL NGO (head of SASOL and technical advisor)

Sasol supports local farmers with sustainable agricultural solutions; i.e. water allocation, restocking, providing tools and knowledge. (http://www.sasolfoundation.co.ke/) Sasol is the main receiver of an EU funded project on ending drought emergencies (focussing on recovery). While the governmental extension services are based on supply and demand regarding crop production, SASOL focusses mostly on improving and stabilising food supply (increasing crop yields over the years) in order to provide sustainable livelihoods for the impoverished local small-scale farmers.

Nyumbani Village (Orphanage director)

The orphanage is a perfect example of a self-subsistence community, but a lot of foreign money was needed to establish this resilient environment. They implemented a plethora of sustainable land management practices, adopting both soil and water conservation measures to climate-smart agricultural practices. The community is almost autarkic but every year, US students start new projects here on improving the water and food security and financial stability of the organisation.

Ministry of Agriculture, Livestock and Fishing (Director of Water and a water technologist)

The department we speak focusses on farmer food security through water supply services. Most priority extension services that they offer concern financial management, investments and on system diagnosis (eg. Pump failure). Besides, they are responsible for the installation of community water harvesting structures like sand dams, bore holes, drink water tanks, wastewater management and river conservation.

Kitui Enterprise on Mango farming (Mango cooperative director)

Before it was an enterprise, the mango cooperative (producing mango, mango juice and mango flour, managed from central Kitui by a committee) was a project outcome of an NGO but then value addition became possible and stable so a business case developed. Mangoes are quite drought tolerant and they are sown into planting pits so they have a small water harvesting already. Some mango farmers have boreholes (most not because it is too expensive) so they have more yield and more quality. Other people dig holes to irrigate too (if they had the training), they encourage the farmers to have different soil and water conservation practices (mulching, ponds, bunds etc.) via extension workers. Now it is a company owned for 70% by the farmers, providing stable income for more than 1150 farmers (mostly woman).

Pastoralist students from SEKU (Bsc Hydrology and Water Resource Management)

Attendees: Seth (West Kenya, Lake Nailot), Peter (Turkana, Plain Nailot), Msinta (close to Tanzania), Kiruan (Turkana, Plain Nailot), Giovanny (Coast, Malingi), Nicolas (Turkana, Plain Nailot)

Main take home messages: Pastoralists adjust during a drought, barely in advance (so no adaptation, only coping strategies). Agricultural drought adaptation strategy: 1. plant cassava, this is drought tolerant. 2. Plant Sisal (woman); herbal product to sell so there is money to buy food.

2. Field visits to farmers investigating adaptation behaviour

During the mission, 5 interviews with example farmers were held with the help of two different translators (between brackets), and are summarized below. Substantive questions that were asked include explanations on their main farming methods and how they protect themselves from drought / which adaptation measures they have in place to prevent crop loss due to water stress. Then it was asked if they installed / implemented these measures alone or with (financial / labour / material) help of the government or NGOs. Besides, we interrogated how they got the knowledge on how to install / implement the measures and if/how they transfer this knowledge to their neighbours / social network. All visited farmers has 'show farms' where other farmers came to have a look and learn, so we asked them how they try to convince others of also adopting the adaptation measures and what the largest limitations were for other farmers in order to find the reasons behind adoption of adaptation measures. Further, we asked their opinion on why other farmers are or are not as successful as them in implementing climate smart agriculture, and how government / NGOs could improve to assure climate smart agriculture in the region.

The overall conclusions of the farmer visit are threefold:

(1) Farmer 2 farmer networks spread adaptation strategies (guided by NGO's). There exist pioneer farmers without extension that want to adopt new structures but they lack knowledge/financial means so still need help from NGO.
(2) When not in the poverty trap, and with knowledge on business and farm financial management (i.a. education), a lot is possible. However, when trapped in poverty, conditional food / financial aid can help build sustainable livelihoods, create families that are not dependent on external support anymore. Initially, rooftop water tanks are too expensive, hence is irrigation, but SWC structures that are self-made are possible. However, there is need for external help – both knowledge and material support – in order to get there.
(3) Take corruption into account; even non-highly educated farmers can educate themselves (using NGOs) and become strong in sustainable climate smart agriculture. However, large costs are still not bearable and corruption and fluctuating market prices do no good.

Maintaining weather station at SEKU

Man (40) and his wife (35), with self-made pond and planting sacs (Winfred Ndanu)

The interviewed farmer dug his own pond day and night because he was tired fetching the water with his motorcycle from the river. He lives on a hill in a 5th order catchment so could easily capture the water flowing downhill if he dug on the right spot. He did not have knowledge but started digging, then an NGO gave him the impermeable textile to cover his pond. The project costed him only the money (KSh 17000) for the fuel for the lamp for digging in the night and a year of hard labour; It greatly improved his yields during last year droughts, they were able to sell their crops to the neighbours (have surplus) while their neighbours all had to buy food because of reduced yields. A future development (idea by the NGO) is to put fish in the pond to start aquafarming.

The interviewed farmer has also planting pits and sacks; he started exploring and testing with them after seeing it somewhere else and then an NGO stepped in to give them proper advice on it. Now the farmer himself joined that NGO and teaches others how to improve the field management, because he beliefs in the farmer to farmer teaching method.

Therefore, he now tries to convince his neighbours to adopt a pond or other water harvesting structure as well, he even started a group for people with the support of an NGO to let them farm together and water their plants. But most of the people did not adopt a water harvesting structure on their own fields. The interviewee thinks they are too lazy, reluctant (woman would do it but lack the knowledge; teaching them would help). Besides, they even try to destroy the pond so the water would flow downstream. It would help if the others were also given the plastic or financially rewarded to build a dam.

Woman Farmer with many kids, with road and rooftop water harvesting (Winfred Ndanu)

First the interviewed lady struggled very hard with drought, she joined a women group that gained profit in burning charcoal. Then they started receiving food aid by MetaMeta on the condition of starting a tree nursery using roadside water harvesting. That worked well. Then they were given rooftop harvesting by NGAAF-Kitui and now they all have a farm with vegetables and maize. The group also collaborated on a pond in a community garden where they produce food together. This community garden started as a family project but now consists of people from the whole village; and is supported by KATOULU NGO.


Young lady farmer who lived with her mother, slopy field with bunds (Emmanuel Mboi)

She used to fetch water from the river but that was ineffective, then she got a rooftop tank given by the governor so she could perform drip irrigation (as all of them do in the neighbourhood). Before she could not irrigate because there is not enough water year round in the river and she could not afford a tank. She has sand bunds to protect her from drought (self-made, 1 week per bund/terrace); got the knowledge to build them from the committee she is member of.


Farmer Mary from rich example farm at Kwam Kiua Muiova (SASOL) (Emmanuel Mboi)

Both our interviewee and her husband were working outside agriculture (he as trader to Nairobi, she as a nurse). With the money they earned, they started small investments on their farm so that they would have a good retirement income. Now they have a shallow well of 85 feet used for gravity drip irrigation, a lot of tanks for roof water harvesting for drinking water, they have two fish ponds for water and fish production; they first bought a generator and now are attached to the electricity network.

They're very improvement-minded. They always went to the national farmer shows giving them info and ideas then they went to the local agro-offices to help with the practical stuff, then they make a business case calculate the expected gains and search for a loan. They did this step by step, small to larger structures, and now they don't even need loans anymore they can invest the money they get from their farms. They made it all themselves (with loans and two incomes). Now they invite other farmers and groups to show their prices and their also lead a local group on sustainable small-scale farming.


Why would people not adopt the same?

- People belief that Mary has divine power, so they don't want to be close to her
- Many lack the willingness to know/ knowledge. Those who are interested, they advise starting small with kitchen gardens and often indeed succeed etc. At the moment, a lot of knowledge building is going on; "within the years to come, water harvesting will happen"
- People do not belief they can take option to have more "when rains are there: relax; if not: problem", but they make no future plans do not thinking ahead; because they are old-fashioned not open to change
- It is costly, money is a problem. People think they need a lot of money they don't have and they don't know how to get loans. When you plan everything and start saving then a small project is feasible. Still, loans are difficult, good plans are necessary (no job? Difficult …) Options to overcome this are organise yourself in groups or going to organisations like ETOLICA that offers water tanks as loan.


Farmer John Kananan Mutui, well-known individual in the area (Emmanuel Mboi)

In this village, a big tank provides drinking water for all farmers around. However, even this one can end up with no water, posing large problems to all households. Politicians started building the tank and infrastructure around till they were out of office, and then stopped. Now the pipes from the tank to the houses are not continued and almost broken; many structures are left unfinished. It is not easy to maintain them themselves and financial capital is the problem. Besides, it is an open goal for corruption: It is illegal to use the water from the drinking tank for irrigation; but Gvt officers sometimes fine you when you irrigate with your own harvested water while claiming you used water from the common tank.

There are enough fields in this area, land is not the problem, the main problem is water: if there is rain, there is enough food to feed everyone given you did work hard on the field (10 bags of maize are needed on average per family). You should not rely on relief help, which is not distributed well and is not enough (3 bags of maize). So you have to arrange yourself during droughts.

Why would farmers adopt drought adaptation structures? It depends on their mind-set (spending vs investing). He himself also started from scratch then produced brick together with the church community, they he knew how to use the brick to build a tank for himself so he did. The MP gave the textile to protect it. Now he trains groups to plant in sacs of soil so a lot of vegetables can be produced. He and his brother (+friends) are now digging a well of 44feet and they distribute the water; it could be done only now since the money was not available (80000KS). Besides, farmers in the area recently finish a dam with a JAICA project (Japan); but other SWC take too much time hence are not adopted because of labour shortage. The use of chemicals is too expensive.

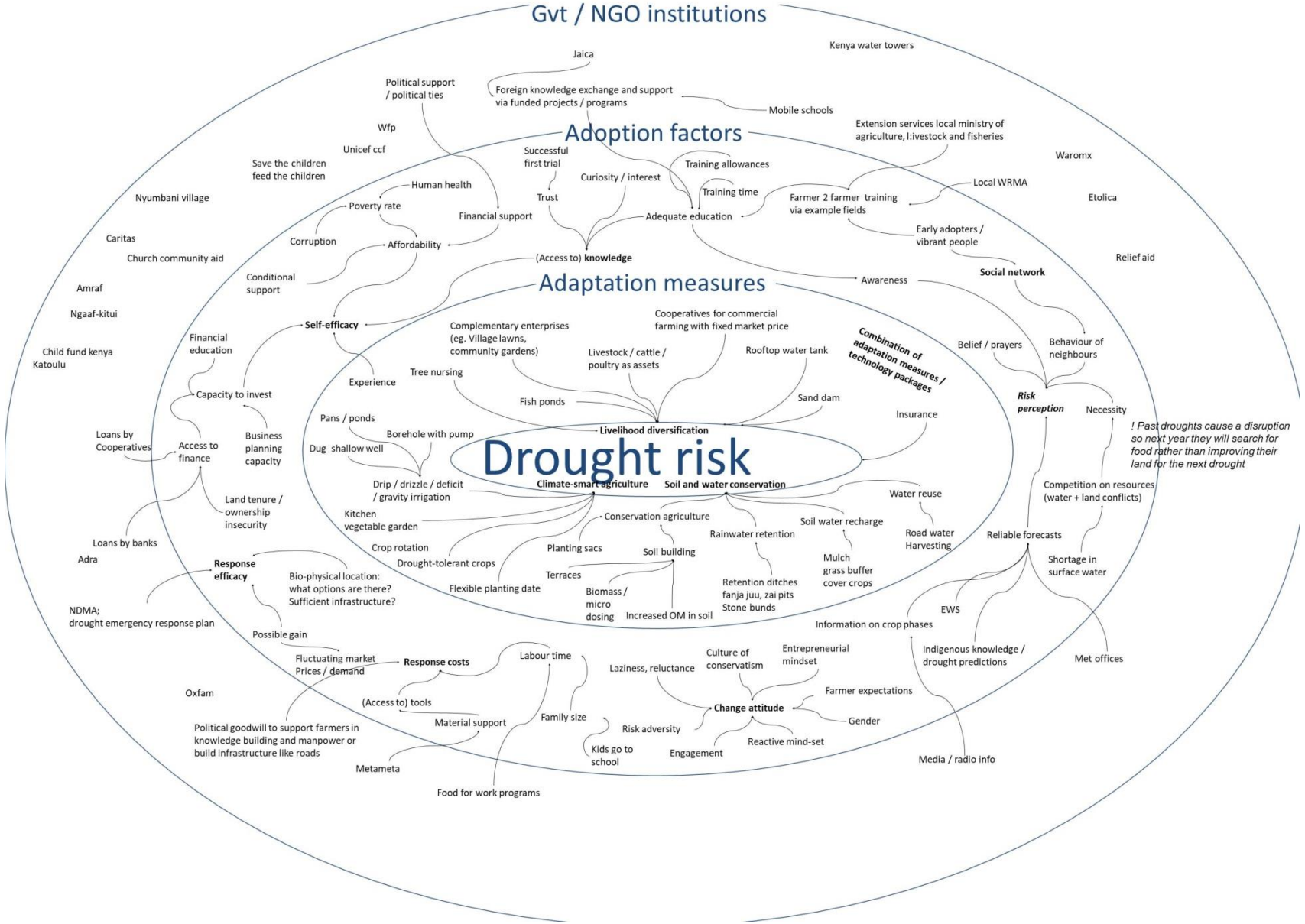
Problem of investment: when there is too much food of the same crop, the market price drops: if there is a lot of maize it is around 20ksh per bag, if few it can go up to 43; for cow peas it is 30-110; green grams 40-80. Supply based changes are horrible for the small scale farmers. The solutions for this are cooperatives that can produce for bigger markets than only local. Such cooperatives can also enable water trade / water management.

3. Schematising the Kitui context - summary

Visit to local sand dam

The scheme as presented below is a rundown of all factors named noted by the spoken people during the mission – officials, NGOs and farmers; in the form of a fuzzy map. A fuzzy cognitive map is a cognitive map within which the relations between the elements of a "mental landscape" can be used to compute the "strength of impact" of these elements, and is often used in modelling decision making in social and political context. Here, the rules of FCM are not followed strictly, as it is only used as a way to visualise the complex process of drought adaptation adoption in the Kitui smallholder farmer context.

The figure includes both the viewpoints of the visited institutions as the personal opinions of the representors of these organisations people and the individual experiences of the visited farmers. It visualises the local context concerning the main drought adaptation strategies and the most adopted climate smart agriculture measures. It gives insight in the processes that play a role in the adoption of these practices and in the important future developments to include in the model. The developed agent based agricultural drought risk model should mimic this situation to the best possible; taking into account the most important and frequent measures and strategies influencing drought risk as possible adaptation decisions, being able to simulate the heterogeneous leverages and limitations influencing the adoption of these adaptation options by the farmer agents in the model and including the different strategies of the most imperative NGO's and governmental authorities as external factors to the model; testing their strategies on the future drought risk. This fuzzy map will serve as guidance on further model development, in order to be able to simulate the situation in Kitui in more detail.


Gvt / NGO institutions
Kenya water towers
Jaica
Political support / political ties
Foreign knowledge exchange and support via funded projects / programs
Mobile schools
Wfp
Unicef ccf
Save the children feed the children
Adoption factors
Extension services local ministry of agriculture, l:ivestock and fisheries
Waromx
Successful first trial
Training allowances
Curiosity / interest
Training time
Local WRMA
Human health
Nyumbani village
Poverty rate
Trust
Farmer 2 farmer training via example fields
Etolica
Financial support
Adequate education
Caritas
Corruption
Affordability
Early adopters / vibrant people
Church community aid
(Access to) knowledge
Relief aid
Social network
Conditional support
Awareness
Amraf
Adaptation measures
Ngaaf-kitui
Self-efficacy
Complementary enterprises (eg. Village lawns, community gardens)
Cooperatives for commercial farming with fixed market price
Combination of adaptation measures / technology packages
Belief / prayers
Behaviour of neighbours
Child fund kenya
Katoulu
Financial education
Livestock / cattle / poultry as assets
Rooftop water tank
Tree nursing
Experience
Risk perception
Necessity
Capacity to invest
Fish ponds
Sand dam
Pans / ponds
Insurance
Livelihood diversification
Loans by Cooperatives
Access to finance
Business planning capacity
Borehole with pump
Dug shallow well
Drip / drizzle / deficit / gravity irrigation
Climate-smart agriculture
Soil and water conservation
Water reuse
Land tenure / ownership insecurity
Kitchen vegetable garden
Conservation agriculture
Soil water recharge
Rainwater retention
Road water Harvesting
Loans by banks
Adra
Crop rotation
Planting sacs
Soil building
Mulch grass buffer cover crops
Response efficacy
Drought-tolerant crops
Terraces
Bio-physical location: what options are there? Sufficient infrastructure?
Flexible planting date
Biomass / micro dosing
Increased OM in soil
Retention ditches fanja juu, zai pits Stone bunds
NDMA; drought emergency response plan
Possible gain
Information on crop phases
EWS
Indigenous knowledge / drought predictions
Met offices
Fluctuating market Prices / demand
Response costs
Labour time
Laziness, reluctance
Culture of conservatism
Entrepreneurial mindset
Oxfam
(Access to) tools
Change attitude
Farmer expectations
Gender
Material support
Family size
Risk adversity
Reactive mind-set
Political goodwill to support farmers in knowledge building and manpower or build infrastructure like roads
Kids go to school
Engagement
Media / radio info
Metameta
Food for work programs
Drought risk
! Past droughts cause a disruption so next year they will search for food rather than improving their land for the next drought
Competition on resources (water + land conflicts)
Reliable forecasts
Shortage in surface water